An Assessment of Watershed Based Projects in the Mississippi River Drainage Basin

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Abstract

Some inventories of ongoing watershed based projects in the United States contain as many as 700 entries. It is estimated that 200–250 of these projects are within the Mississippi River Drainage Basin. The goals of the projects are varied: control of nonpoint sources of nutrients or pesticides or both; control of suspended solids from soil erosion; education of the public about the value of the watershed; monitoring of various pollutants; protection of various fisheries; etc. On a national level the projects range in size from 5 acres to over 150 million acres in size. Funds have been obtained from federal, state, and private sectors on many of the projects.

In a recently released report, the General Accounting Office concluded that two factors are necessary for success in watershed management projects:

1. Flexibility in the kinds of financial and technical assistance provided by the federal agencies

2. Local tailoring of approaches to watershed management that allows for differences in the type and source of pollutants, local agricultural practices and the community's attitudes.

Overview of Existing Watershed Management Programs

Introduction

From the beginning of the modern age people have recognized that natural systems of varying scale are related. For example, Jonathan Swift's familiar little poem:

> *So naturalists observe a flea*
> *Hath smaller fleas that on him prey;*
> *And these have smaller still to bite 'em*
> *And so proceed ad infinitum.* (Swift, 1733)

It is not surprising then that participants in the Gulf of Mexico Program understood from its beginning that the Gulf of Mexico ecosystem is connected to that of its watershed. At the first meeting of the Public Health Committee in March, 1989 members of the Public Health Committee were overwhelmed by the enormous size of the area from which pollutants that could potentially affect the Gulf could arise. Dr. Merrill McPhearson of the Food and Drug Administration acknowledged that the Gulf is influenced by its entire watershed, but by using a deliberate, systematic approach the issues could be dealt with. He suggested that we begin at the bottom of the watershed, identify and rank the public health problems, determine the causes wherever they were located in the watershed and finally develop solutions. This is the path of

action that all of the issue committees have been following in developing characterization reports and action agendas.

The members of the Gulf of Mexico Program's Nutrient Enrichment Committee members also recognized the potential impact of nutrients getting into the Rivers far upstream on the Gulf. Based on this understanding of the problem the committee recommended that the Program undertake several activities. One of the first efforts was an attempt to develop a compendium of sources and quantities of nutrients in the rivers of the entire Gulf of Mexico watershed. This report was produced by staff at Purdue University from USGS data taken from the EPA STORET database (USEPA, 1992a)**.** While the report was not sufficiently detailed to determine the sources of nitrogen to the Mississippi River, it was clear that most of the nitrogen in the River at St. Francisville, Louisiana was already in the River at Cairo, Illinois. A companion report described the information available on the effects of nutrient overenrichment in Gulf waters; the hypoxic zone on the Louisiana-Texas shelf was described as an area where there was evidence for excess nutrient input (U.S. EPA, 1992b).

In the spring of 1993 the Gulf of Mexico Program partners organized and conducted a Mississippi River Project to educate students about the issue of nonpoint source pollution, sources of nutrients, effects of nutrient over-enrichment, and to make them aware of the fact that their actions far up the Mississippi River could affect the Gulf of Mexico. Vice President Al Gore participated in the project. The Project was successful in reaching students and the public at large through the media coverage that resulted. The project report states that, "Beyond any doubt, students enthusiastically and overwhelmingly responded to the project, its activities and issues. Their letters, comments to Vice-President Gore, and to reporters underscore their desire to actively make a difference in the quality of the environment." (Mote, 1993) The effort to raise public awareness upstream was continued this year when the Program awarded a project (GMPO, 1995a) to develop educational information and displays that will illustrate the effects that excess nutrients in the River can have on the Gulf and the importance of controlling nonpoint sources of nutrients to the River in the upper reaches of the watershed.

The Gulf Program participants have also recognized that one of the most effective ways to reduce nutrient input into the river upstream will be to forge partnerships with similar groups in the Gulf of Mexico watershed to control impacts on the Gulf ecosystem. To this end we have begun to identify these groups and have now a preliminary inventory of 48 activities and projects. (GMPO, 1995b) We intend to complete and maintain this inventory of watershed projects and to build a network for action and education with these groups. This paper describes what we have learned so far about them.

We know from an inventory completed in June of this year by the General Accounting Office (GAO, 1995) that there are considerably more projects than 48 in the Mississippi River Basin. The national GAO inventory reported the identification of 618 watershed based projects aimed at agricultural sources of pollution that have received federal funding. I have estimated that between 200 and 250 of these projects are within the Mississippi River watershed. The GAO reviewed nine of these projects in detail; four of these projects were in the Mississippi River watershed. The conclusions of the GAO report will be summarized later in this paper.

Funding and initiative for many of the projects in the Gulf Program's preliminary inventory are provided by the federal government thru EPA,

NRCS, USGS, etc. The funding is provided either solely by the government or there is a cost sharing between federal and state government. Funding does not always refer to direct monetary contribution; "in-kind" funding such as technical expertise and cooperation were provided for many projects by the "funding" agency. At least five of the projects are being conducted using no federal funds; they are funded by private landowners and local property taxes. The projects represent a wide spectrum of management activities at a variety of technical and nontechnical levels. All of the projects are relatively new; the oldest project began in 1986.

Of the 48 projects identified, 12 were basin specific projects of the USGS National Water-Quality Assessment Program. The purpose of this Program is to identify factors that affect water quality and monitoring to determine levels of pollutants. At this conference USGS personnel have presented information based on these projects. This information will be necessary to determine changes in nutrient loading in the rivers and consequently will allow for a measure of the effectiveness of remedial actions taken in the watershed. The remainder of the projects focus on activities to manage and control pollution problems.

The objectives of the management projects ranged from increasing public awareness to multiple objectives such as improving water quality, developing public outreach documents, and implementing best management practices. Most projects have the general objective to improve water quality.

The objective of the four projects occurring in Pennsylvania is the control of drainage from abandoned mines. However, one of the treatment options being considered or actually implemented in each of these projects is the use of a passive wetland treatment system which will be effective for control of nutrients and sediments as well as acid mine drainage and heavy metals which are the primary focus of the projects. About 20 projects focus on three specific objectives:

1. farm animal waste management
2. fertilizer use reduction
3. erosion control;

all of which will help reduce nutrient flux to the rivers.

Three sets of the projects in the preliminary inventory will be reviewed in some detail as examples of the types of activities: Table 17 describes those projects in Arkansas that received funding and support from NRCS, Consolidated Farm Service Agency and the Extension Service; Table 18 provides information on the TVA River Action Team Projects and Table 19 summarizes those projects from the GAO report that received no federal funding. Many of these projects have as one of the goals the reduction of nonpoint source pollution of the river by nutrients. The NRCS and the TVA are active partners in the Gulf of Mexico Program, so working with these upstream projects will be easily accomplished.

Although many projects have resulted in successes such as decreases in erosion or reduction in fertilizer application, few of the projects have been able to quantify their successes (such as: reduction of soil erosion by 7 ton/acre or nitrogen application reduced by 70 pounds/acre). Participants in almost all of the projects reported "unquantifiable" successes, including reports from farmers that they were satisfied with best management practices and new technologies introduced by the program and they would continue to use them; establishment of

citizen action and interstate cooperative groups; distribution of public outreach material. These "unquantifiable" successes are the first step to implementing actions that will lead to quantifiable results. Because environmental problems cannot be corrected instantly, a series of indicators of progress toward the ultimate environmental goal is needed. The Gulf of Mexico has adopted a hierarchy of indicators to measure success in achieving the many steps toward our goals. This hierarchy is shown in Figure 102. A suite of indicators to indicate progress toward reducing extent, severity and duration of the hypoxic zone in the Gulf will be developed as part of the strategic assessment and planning process.

The General Accounting Office inventory of watershed based projects was limited to those that have received federal funding and are aimed at agricultural sources of pollution. If it is assumed that the projects in states that are only partly in the Mississippi River watershed are distributed uniformly across each state, it can be estimated that between 200 and 250 of these projects are within the Mississippi River watershed. Nationally the projects ranged from as small as five acres to over 150 million acres in size; they involved both surface and ground water resources; and they addressed such agricultural pollutants as animal waste, fertilizer runoff, pesticides and soil sediment. Through early 1995 these projects had received an estimated $514 million in federal funds.

They reviewed nine of these projects in detail; four of these were in the Mississippi River watershed. Table 20 presents a few facts about these projects.

The Project participants pointed out that even given rigorous monitoring, demonstrating a link between changes in land use and diminished chemical pollution is difficult, if not impossible, especially within a short time frame. Participants in several projects noted that current science can demonstrate only a tenuous link between land use practices and water quality, and it may take years for their projects to produce chemical improvements in water quality. Participants in the Big Spring Basin project said that climatic variations, such as droughts followed by years of heavy rainfall, and other factors have made it difficult to establish a link between changes in farming practices and groundwater quality, despite more than 10 years of monitoring and analysis.

The GAO reported that while their conclusions from a thorough study of 9 watershed projects cannot be projected to the entire inventory of 618 projects, participants in all nine agreed on two key factors for success that have been learned during the course of the projects:

1. Flexibility in the kinds of financial and technical assistance provided by federal agencies

2. Local tailoring of approaches to watershed management.

Because watershed projects differ in characteristics such as the type and source of pollutants, local agricultural practices, and the community's attitudes, participants believed that a prescriptive, one-size-fits-all approach would be inappropriate. At the local level, the projects' participants emphasized to the GAO that the keys to reducing agricultural pollution include

1. Building citizens' cooperation through education

2. Getting stakeholders to participate in developing the project's goals

3. Tailoring the project's strategies, water quality

monitoring, and regulatory enforcement efforts to local conditions.

Conclusion

All of the watershed protection activities were begun to protect the water quality of a particular section of a creek or river in this great watershed; none were undertaken specifically to reduce the severity or extent of the hypoxic area in the Gulf. However, the combined effort of all of these management projects and the support of citizens living in the Mississippi River Basin should result in measurable improvements in the Mississippi River water quality that will be detected by monitoring projects such as the USGS National Water-Quality Assessment Program and ultimately reduce the nutrients reaching the Gulf via the River. In fact, while it is too early to say with certainty, the summary of existing data as presented by Turner and Rabalais (1991) indicates that nitrate-nitrogen concentrations in the Mississippi River at St. Francisville and New Orleans, Louisiana may have begun decreasing in the late 1980's which would be commensurate with the formation of these pollution management projects within the basin.

As the Gulf Program works to develop viable solutions through a strategic assessment process, we will rely to a great extent on these existing programs to provide existing data, to participate in the assessment process, to identify and prioritize the areas of greatest need and to undertake demonstration projects to initiate implementation of the strategic plan.

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Table 17.

Watershed projects identified in Arkansas.

Title	Began	Acres	Budget/Year	Purpose/Goal
Long Creek Ag. NPS HUA[1]	1991	96,574	~$1.6 million (proposed 5-yr budget)	Reduction of nutrients and pathogens from animal waste
Millwood Lake Watershed Demo. Project	1991	1,325,000	~$1.5 million (proposed 5-yr budget)	Provide for disposal of manure from poultry and swine operations using BMPs[2]
Muddy Fork of the Illinois R. Ag. NPS HUA	1990	47,122	~$2.5 million (proposed 6-yr budget)	BMPs include waste management for confined animal operations and nutrient management for pasture lands

[1]Agricultural Nonpoint Source Hydrologic Unit Area
[2]Best Management Practices

Table 18.

TVA Sponsored River Action Teams (RAT).

Rat Title	Began	Area	Funds/Yr	Goals/Actions
Flint Creek	1992	290,000 acres	$2.15 million FY92–FY94	Animal waste lagoons; Wastewater irrigation systems; composters for poultry operations; no-till agriculture
Wheeler Elk	1993	5,180 sq. miles	Not available	Install oil/water separator on parking lot; encourage agricultural BMPs
Chickamauga	1995	1,865 sq. miles	Not available	Acid mine drainage remediation
Hiwassee	1992	2,700 sq miles	~$1 million	Stream bank stabilization; animal waste management; erosion control; public education; 20–30 projects/ year.
Holston	1993	3,776 sq miles	Not available	Identification of NPS sources; Installation of 6 Agricultural BMPs; Elimination of unpermitted discharges; Monitoring
Watts Bar...	1994	1,370 sq miles	Not available	Goal is to solve pollution problems in the watershed. Public education and outreach.
Clinch-Powell	1993	2,954 sq miles	Not available	Constructed animal waste treatment system and live stock exclusion fences, revegetated riparian zones

Table 19.
Projects receiving no federal funding.

Title	State	Project Sponsors	Goals/Activities
Piasa Creek Watershed Partnership	Illinois	Am. Farmland Trust Piasa Creek Conservancy Great Rivers Land Trust	Establish water retention basins. Create field buffers and filter strips. Develop whole farm nutrient plans.
Pontiac/Skeator Watershed Area	Illinois	Northern Illinois Water Company	Reduce fertilizer use. Involve and educate citizens. Comply with nitrate/nitrite DW Limits.
Chippewa River Stewardship Partnership	Minnesota	Am. Farmland Trust Chippewa R. Stewardship Partnership	Improve Water Quality. Restore wetlands and riparian areas. Reduce Flood Damages.
S. Washington Watershed District	Minnesota	City of Woodbury MN Board of Water and Soil Resources	Management of urban runoff to control nutrients, sediment, salinity. Control of flooding.
Tributaries of Stillwater, Rock Creek	Montana	Land and Water Services and private landowners	Reduce soil erosion and nitrogen by moving corrals and stockyards away from the river and revegetating banks.

Table 20.
Selected watershed projects in the Mississippi River drainage basin from GAO report.

Watershed	Area (Acres)	Total Funds	Duration
Otter Lake, IL	12,255	$292K	1992–1995
Big Darby Creek, OH	371,000	$5,145K	1990–1995
Black Earth Creek, WI	64,000	$3,245K	1986–1994
Big Spring Basin, IA	66,000	$7,119K	1982–1993

Presentation Discussion

Fred Kopfler (Gulf of Mexico Program—Stennis Space Center, MS)

Daniel Ray *(The McKnight Foundation—Minneapolis, MN)* gave an example of the scale of the community-based watershed management infrastructure in place in the upper Midwest, saying that the McKnight Foundation is involved with supporting a network of community-based activities that span throughout the Mississippi watershed and above the quad-cities. He believed this area was approximately 12 percent of the overall Mississippi River Watershed. He said they have identified about 110 community-based, initiatives that cover about one third of the watershed, not including the involvement of federal land. He finalized his comments saying that there is a huge infrastructure available and ready for some direction to pursue a strategy. This infrastructure should be effectively linked into the Gulf Coast comprehensive program.

Fred Kopfler told the audience that Daniel Ray was one of the individuals contacted by Battelle who provided a lot of information. Much of the material was received by Battelle too late in the government fiscal year to be incorporated into the report. The Gulf of Mexico Program has some revisions and changes in format that they will give to Battelle for incorporation into the final report and these changes will include all of the updated information. He agreed to follow up with Daniel Ray to make sure all those organizations are included.

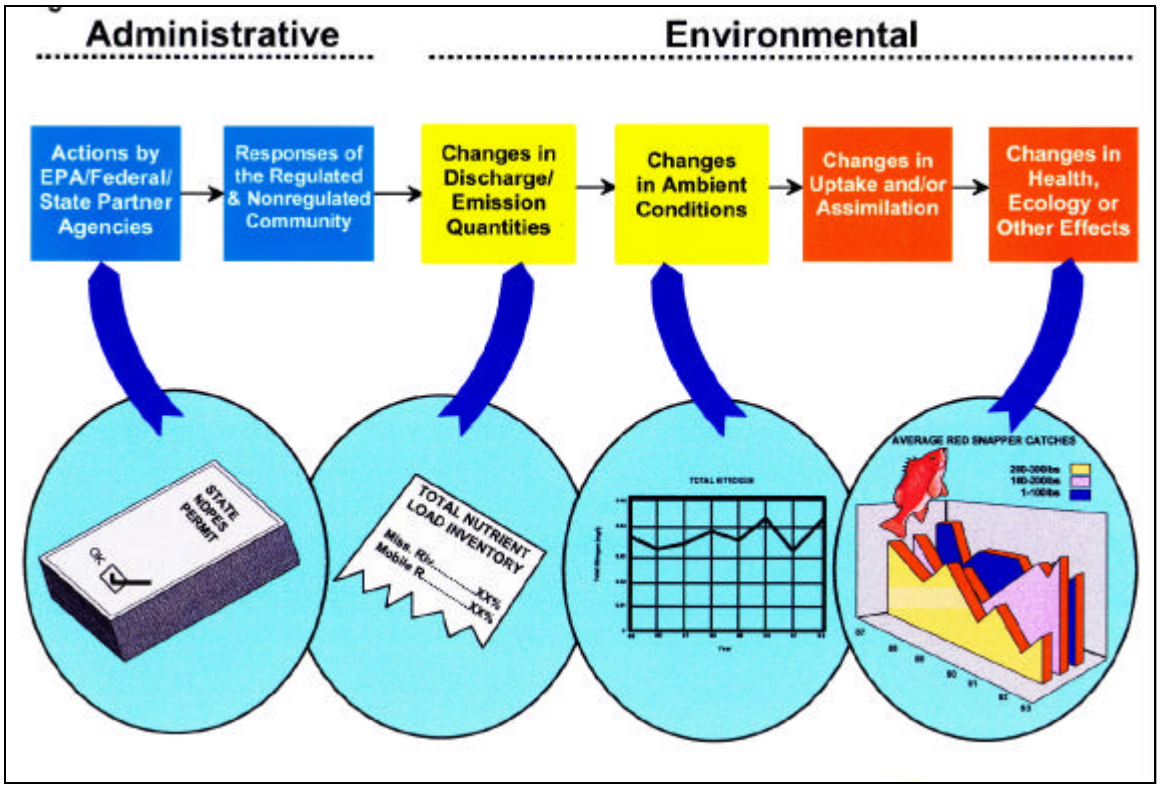

Figure 102.

An illustration of a hierarchy of indicators that can be used to track progress toward an environmental goal before results are measurable in the field.